

# NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



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## THESIS

### AN ANALYSIS OF PROMOTION TO O-4 IN THE 1983 COHORT

by

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March, 1996

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AN ANALYSIS OF PROMOTION TO O-4 IN THE 1983 COHORT

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B.S., National Defense Management College - 1986

Submitted in partial fulfillment  
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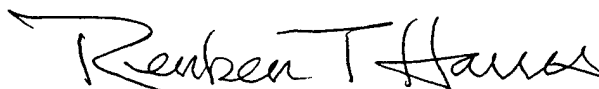
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## **ABSTRACT**

This thesis uses data from the 1983 cohort file merged with a college file obtained from the Defense Manpower Data Center (DMDC). This analysis focuses on the promotion rates of graduates of historically black colleges and universities (HBCUs). I estimate a model of promotion to LCDR 0-4 using a Maximum Likelihood Estimation (logistic) technique. I report the results using the "notional-person" approach; reporting the marginal effect of changes in the explanatory variables on promotion to LCDR.

Results of the study include: female promotion rates are higher than that of males', promotion rates are higher for graduates of aviation officer training programs than for graduates of military academies or ROTC programs, finally, promotion rates for officers who graduated from HBCUs are not significantly different than promotion rates for other officers.



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I would like to present this thesis as a testament to their dedication and encouragement.

## **I. INTRODUCTION**

### **A. BACKGROUND**

Since 1974, defense drawdowns resulted in increasing concern for retaining the most qualified officers. It follows that promotion should reflect and be based on an individual's performance. Characteristics leading to increased probability of promotion should indicate a higher level of performance. Those who perform well should be more likely to be promoted. If the systems of promotion and retention are successful, then the most qualified officers should be more likely to remain on active duty.

Many studies have analyzed what characteristics determine an officer's chance of promotion to O-4. Historically, this is the first significant bottle-neck that an officer encounters in his or her career progression. It takes about ten years of commissioned service to attain this grade. Generally speaking, few studies focus on minority promotion, especially on attending historically black colleges and universities (HBCU).

### **B. RESEARCH QUESTIONS**

The primary research question of this thesis is to identify which characteristics lead to higher probabilities of promotion. The thesis examines different factors in promotion rates, such as an officer's personal demographics, age, source of commission, race, education level, marital status, number of dependents, and the college attended, etc., and the relationship of these factors to promotion.

The second research question addresses the issue of promotion for officers who have graduated from HBCUs and their likelihood of being promoted to O-4.

#### **C. SCOPE AND LIMITATIONS**

This study uses two databases, a cohort data file and a college data file obtained from the Defense Manpower Data Center (DMDC). The study only addresses the probability of promotion to O-4 (Lieutenant Commander or Major) and the factors affecting promotion. Additionally, the study focuses on the effect on promotion of graduating from a HBCU.

#### **D. ORGANIZATION**

Following the introduction and background, Chapter II offers a review of the literature dealing with the issues of historically black college and university education, and discusses ROTC Programs. Chapter III presents a detailed description of the data employed and results of preliminary data analysis in the 1983 cohort data file, college and merged files, and then describes the methodology and sets up a Logit model. Chapter IV contains the analysis of the Logit model. Chapter V offers conclusions and recommendations based on the analysis.



## **II. BACKGROUND AND LITERATURE REVIEW**

### **A. BACKGROUND**

The majority of commission officers come into the services through the service academies, Reserve Officer Training Corps (ROTC), and Officer Candidate School (OCS).

This study focuses on Reserve Officers' Training Corps (ROTC). ROTC programs are offered by the Army, Navy (including Marine Corps), and Air Force in approximately 500 colleges and universities across the country. ROTC is a program designed to train and commission junior officers into the active and reserve components of the Armed Forces. Students who enroll in ROTC and qualify may receive financial assistance in exchange for active and reserve military service. ROTC consists of classroom academic courses, functional military training and field exercises, physical fitness and annual summer training of several weeks.

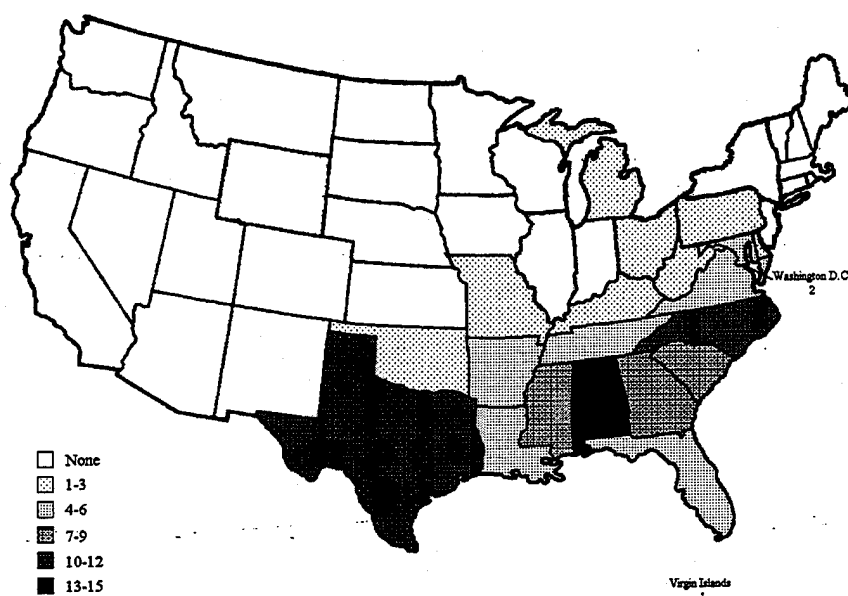
The Army ROTC was established in 1916. The ROTC commissions students as second lieutenants in the U.S. Army and is the Army's major source of college-trained officers. Both two- and four-year programs are available. Military obligation is incurred after successful completion of both a basic and an advanced ROTC course. In the 1983 cohort data file, there are 2434 officers (36.4%) from the total of 6696 in the Army population of the database whose source of commission is ROTC.

The Navy ROTC Program was established in 1926. The Naval Reserve Officers' Training Corp (NROTC) is a source of Regular Navy and Marine Corps Officers. In 1983 cohort, there were 934 officers (17.1%) from 5452 Navy population and 724 officers (38.9%) from 1860 Marine Corps population whose source of commission was NROTC.

The Air Force ROTC began in 1946 when the Air Force was established and offered the opportunity for a commission in the United States Air Force. An Air Force scholarship program (2-4 years) is available to full-time students who satisfy specific requirements. In 1983 cohort, there are 3698 officers (45.8%) from 8080 Air Force whose source of commission is ROTC (Statistical data from DMDC). [Ref. 1]

## **B. HISTORICALLY BLACK COLLEGES**

Virtually, all of the historically Black Colleges and Universities are located in the Southern U.S. Appendix A lists 102 predominant Historically Black Colleges and Universities in 1996, by state. Figure 1 shows the distribution of Historically Black Colleges and Universities.



**Figure 1. Distribution of Historically Black Colleges in 1996**

## **1. The Role of the Historically Black Colleges and Universities**

Black institutions have maintained their position as key suppliers of advanced education to Blacks and as producers of talented undergraduates for advanced study in all institutions.

Black colleges serve an additional function in meeting the needs of a defined cultural community and are essential elements of the educational system. Because federal/private foundation funds for research and development have largely been denied the nation's Black Colleges these schools are confronted with unique problems in administration and program priorities, which impact the production and distribution of black graduates. [Ref. 2]

Black colleges have had a greater influence than is represented by the number of their graduates. These colleges have developed primarily in the south under the pressures of segregation. Consequently, they are unique institutions and have had a disproportionately higher impact on the progress made by the Black population of the United States, both North and South.

## **2. Enrollment in Historically Black Colleges and Universities**

Beginning in the mid-1960's, black students had access to more financial resources to attend colleges, both from their families and from government aid. In 1970's, non-traditionally black institutions were required to increase the number of black students and faculty on their campuses. Perhaps due to these trends, in the 1980's, total enrollment in traditionally black institutions declined slightly (3%) from 222,220 to 216,570.

Much of the decline in total enrollment can be attributed to a drop in freshmen enrollment. The number of first-time

freshmen declined 12 percent from 54,940 in 1980 to 48610 in 1982 [Ref. 4, p. 19].

### **3. Employment Opportunities for Graduates of Historically Black Colleges**

The New York-based Hanigan Consulting Group reports that minority graduates received 23 percent more job offers than did whites even though they had 28 percent fewer job interviews. The average starting salary for minority graduates was \$34,565, compared with \$34,152 for white graduates in 1995.

A *Black Enterprise* story (relating a U.S. Office of Personnel Management (OPM)) report suggested 23 actions and innovative recruiting techniques to ensure that students get information about federal job opportunities early in their school years. The report also suggests initiatives to strengthen and forge new partnerships between the government and HBCU communities. *Black Enterprise* noted that most federal agencies have not recruited on HBCU campuses and surmised that ".... They believe they will not get the best recruits from HBCUs." There may be no foundation for this conclusion; indeed, HBCUs have produced three-fourths of all black officers in the Armed services [Ref. 6, p.29].

The *Black Enterprise* analysis says minority students received more job offers and higher starting salaries because they were better qualified than their white peers.

### **C. LITERATURE REVIEW**

The Industrial and Labor Relations Review (ILR) uses data from the National Longitudinal Survey of the Class of 1972 to analyze the effect of attending historically black colleges and universities (HBCU) on future wages of black students [Ref. 8]. She found that although the pre-college

characteristics of students who attended HBCUs predicted lower wages than did the pre-college characteristics of students who attended mixed or historically white 4-year institutions, the value added in future wages from attending HBCUs was 38 percent higher than that from attending traditionally white or mixed institutions. [Ref. 8, p.531-546]

Loren M. Solnick examined the impact of attending a "black" college on the job success of a sample of black college graduates employed by a large manufacturing firm. He found that the graduates of black colleges start with higher salaries, but receive smaller wage increases and fewer promotions than comparable graduates of non-black colleges. [Ref. 9, pp. 135-148.]

John E. Lux's NPS thesis suggests that HBCUs may be a prime source of recruitment for "quality" officers, and that increasing recruitment at HBCUs may assist the armed forces in raising levels of black representation within the officer corps. [Ref. 10]

Peggy F. Simpson researched the promotion opportunities of minorities to the controlled grades in the Navy Nurse Corps. She found that minority status and gender are found to be statistically insignificant factor affecting promotion at the Captain and Commander selection levels (O-5, O-6); however, at the Lieutenant Commander (O-4) selection level, gender and minority status have a statistically significant negative effect on promotion. [Ref. 12]

#### **D. SUMMARY**

The literature cited above does not clearly describe the type of analysis this thesis employs. It does, however, provide a framework and theoretical basis for examining the

relationship between college resources and officer performance.

In the aggregate, given a minority member and a majority member who entered the military in 1971 completing their obligated service, having identical academic credentials, marital status, time in pay grade, discipline records, and occupational classifications, the minority member will be promoted at least as quickly as the majority member. This phenomenon reflects the emphasis the military has placed on minority advancement since 1972. [Ref. 11, p.90].

This study is to evaluate the relative impact of the current performance evaluations on minorities' and nonminorities' promotion rates. The performance evaluation model range for time in service is from twenty-four to fifteen years. The following in-service variables are statistically related to pay grade level: time in the service, discipline record, leadership and appearance evaluations and occupational classification. These factors are extremely important to an individual's promotion success. In the aggregate, there are few differences between race-ethnic groups' scores in leadership and appearance evaluations.

### **III. DATA AND METHODOLOGY**

#### **A. Preliminary Data Analysis**

This thesis uses two databases, a 1983 cohort datafile, and a college datafile obtained from the databases of the Defense Manpower Data Center (DMDC). This chapter first presents an analysis of 1983 cohort data. The analysis uses data for:

- Sex (Male, Female)
- Source of Commission - Academy, Reserve Officer Training Corps (ROTC), Officer Candidate School (OCS), direct appointment professional, direct appointment non-professional, Aviation Training Program
- Race - White, Black, and other race (Hispanic, American Indian, Alaskan Native, Asian/Pacific Islander, and others).
- Education Level - college, masters, doctorate
- Age at Entry

Next this chapter introduces the college file and the file merged 1983 cohort file. The college file was obtained from DMDC. The merged file is analyzed with the above characteristics, focusing on HBCU graduates.

##### **1. 1983 Cohort Data Analysis**

In 1983 cohort data obtained from DMDC, there are 29,264 observations including Army (10,321, 35.3%), Navy (7,536, 25.8%), Air Force (2,233, 7.6%) and Marine Corps (9,174, 31.3%) data. The observations are yearly for all years between 1983 and 1994.

Data observations with rank below ensign (O-1) at entry into military service (in 1983) were deleted because the analysis concentrates on promotion from O-1 (ensign, or first lieutenant) to O-4 (lieutenant commander or major). All records where sex, race, or source of commission are unknown

were deleted. With the above deletions, the sample observations decreased from 29,264 to 16,520.

*a. Specification of the Variables*

In order to determine which environmental characteristics affect officers' performance and promotion, the thesis conducted a series of analyses involving a number of characteristics, such as sex, source of commission, race, education level, age at entry, and college attended. These variables are based on the 1983 cohort file. (When a variable is "yes" or "no", a value of "1" indicates the variable is "yes", otherwise it equals "0"). The variable descriptions are shown in Table 1. The means and standards deviations of these variables are shown in Table 2.

The age at which an officer enters military service may be an indication that this officer has more experience and could indicate that he/she is more likely to be promoted.

Most officers entering the military are between 21 and 25 as shown in Figure 2. This is an indication that most officers receive their commission via ROTC or OCS after college. Officers who entered service earlier (17-21) may have received their commissions from the military academies or may possibly be ex-enlisted members who obtained a college degree and were commissioned either through OCS or an Aviation Program. The majority of officers' source of commission was ROTC or OCS as shown in Figure 3.

The overwhelming majority are white as shown in Figure 4 with 90.94 percent, black 6.83 percent and other race are 2.23 percent. Because the majority of officers are white, the second question addressed in this study, whether HBCUs have an affect on the promotion rate to O-4, is based on less than 10 percent of the cohort data with even a smaller percentage of Black officers attending a HBCU.



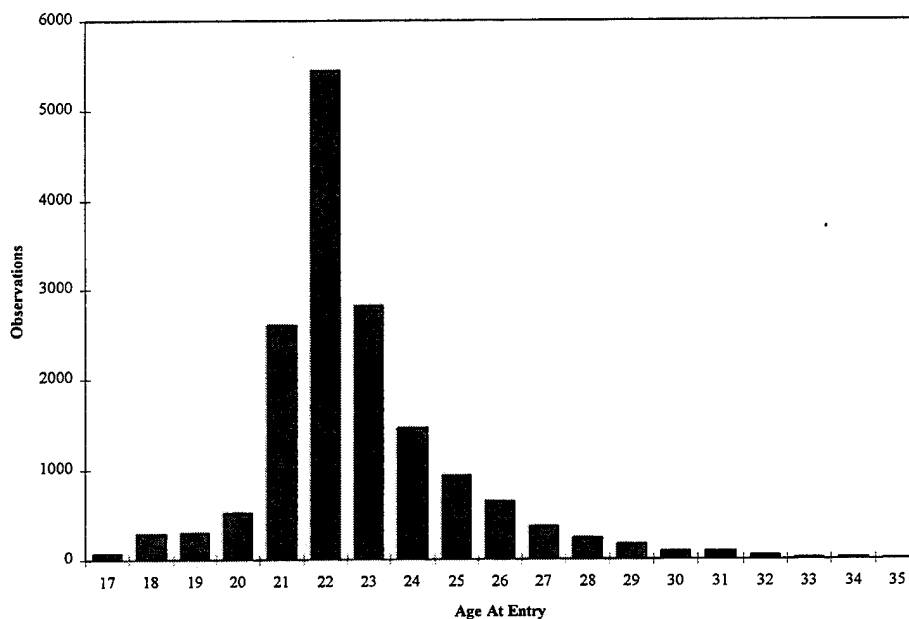


Figure 2. Distribution of Age of Entry

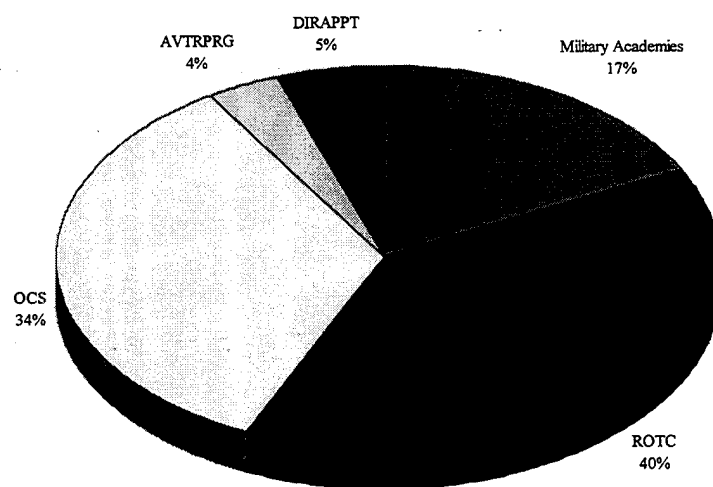
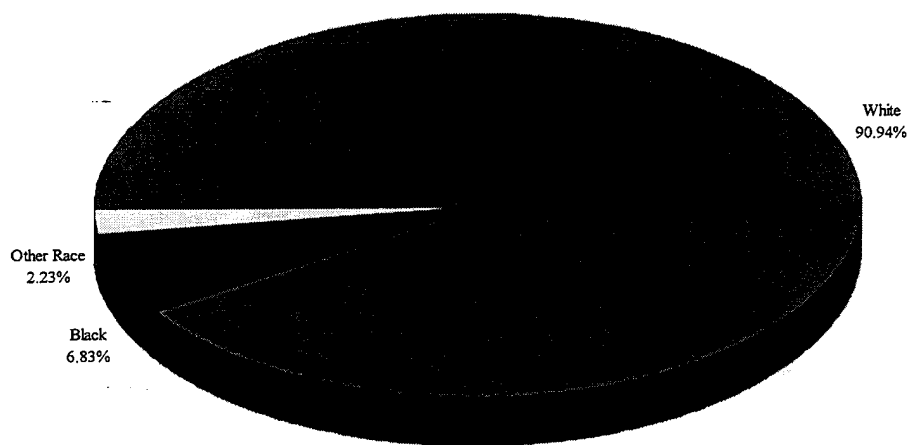


Figure 3. Source of Commission



**Figure 4. Racial Makeup**

|                   |  |
|-------------------|--|
| <b>PG83</b>       | Members' (officers) pay grade (rank) as of June 1983. O-1 is the lowest pay grade; O-11 is the highest   |
| <b>MALE</b>       | Male   |
| <b>FEMALE</b>     | Female   |
| <b>ACADEMY</b>    | Source of commission is military academy   |
| <b>ROTC</b>       | Source of commission is Reserve Officer Training Corps   |
| <b>OCS</b>        | Source of commission is Officer Candidate School   |
| <b>AVTRPRG</b>    | Source of commission is Aviation Training Program  |
| <b>DIRAPPT</b>    | Source of commission is Direct Appointment Professional & Non-Professional   |
| <b>WHITE</b>      | Individual is member of white race   |
| <b>BLACK</b>      | Individual is member of Black race   |
| <b>OTHER RACE</b> | Individual is member of one of the following ethnic groups: Caucasian of Spanish descent, American Indian, Asian American, Puerto Rican, Filipino, Mexican American, Eskimo, Cuban American, Chinese, Japanese, Korean |
| <b>COLLEGE</b>    | individual obtained college degree   |
| <b>MASTER</b>     | Individual obtained masters degree   |
| <b>DOCTOR</b>     | Individual obtained doctoral degree  |
| <b>E_AGE</b>      | Age at which individual entered the military   |
| <b>FROM</b>       | Pay grade equal 21 in 1983 and pay grade equal 24 after 1991 as dependent variable in Logic model  |

\*All the above are dummy variables except the E\_Age variable; if the event is true, then variable = 1, otherwise the variable = 0.

**Table 1: Variable Descriptions**

| Variable   | Label                 | N     | Mean       | Std Dev   | Minimum   | Maximum   |
|------------|-----------------------|-------|------------|-----------|-----------|-----------|
| MALE       | MALE                  | 16520 | 0.8739104  | 0.3319604 | 0         | 1.0000000 |
| FEMALE     | FEMALE                | 16520 | 0.1260896  | 0.3319604 | 0         | 1.0000000 |
| ACADEMY    | COM FM MIL SCHOOL     | 16520 | 0.1736683  | 0.3788354 | 0         | 1.0000000 |
| ROTC       | RES OFCR TRNG CORPS   | 16520 | 0.3949758  | 0.4888603 | 0         | 1.0000000 |
| OCS        | OFCR CANDIDATE SCHOOL | 16520 | 0.3412833  | 0.4741546 | 0         | 1.0000000 |
| AVTRPRG    | AVN TRNG PROGRAM      | 16520 | 0.0384988  | 0.1924029 | 0         | 1.0000000 |
| DIRAPPT    | DIR APPT              | 16520 | 0.0515738  | 0.2211718 | 0         | 1.0000000 |
| WHITE      | RACE: WHITE           | 16520 | 0.9093826  | 0.2870730 | 0         | 1.0000000 |
| BLACK      | RACE: BLACK           | 16520 | 0.0683414  | 0.2523385 | 0         | 1.0000000 |
| OTHER RACE | RACE: OTHER           | 16520 | 0.0222760  | 0.1475843 | 0         | 1.0000000 |
| COLLEGE    | BACHELORS DEGREE      | 16520 | 1.0000000  | 0         | 1.0000000 | 1.0000000 |
| MASTERS    | MASTERS DEGREE        | 16520 | 0.3004843  | 0.4584825 | 0         | 1.0000000 |
| DOCTOR     | DOCTORATE             | 16520 | 0.0041162  | 0.0640276 | 0         | 1.0000000 |
| E_AGE      | AGE AT ENTRY          | 16520 | 22.3900121 | 3.6724849 | 17        | 35.000000 |
| PROM       | PROMOTED TO 04 IN 94  | 16520 | 0.8573245  | 0.3497523 | 0         | 1.0000000 |

**Table 2. Means and Standard Deviation of Variables**

|                               |       |         |   |
|-------------------------------|-------|---------|---|
| <b>Sample Size</b>            | 16520 | 100%    |   |
| <b>Variables Total Sample</b> |       |         |   |
| <b>Sex</b>                    |       |         |   |
| <b>Male</b>                   | 14437 | 87.39%  |   |
| <b>Female</b>                 | 2083  | 12.61%  |   |
| <b>Source of Commission</b>   |       |         |   |
| <b>Military Academies</b>     | 2869  | 17.37%  |   |
| <b>ROTC</b>                   | 6525  | 39.50%  |   |
| <b>OCS</b>                    | 5638  | 34.13%  |   |
| <b>AVTRPRG</b>                | 636   | 3.85%   |   |
| <b>DIRAPPT</b>                | 852   | 5.16%   |   |
| <b>Race</b>                   |       | 0.00%   |   |
| <b>White</b>                  | 15023 | 90.94%  |   |
| <b>Black</b>                  | 1129  | 6.83%   |   |
| <b>Other Race</b>             | 368   | 2.23%   | Hispanic, American Indian/Alaskan Native,<br>Asian/Pacific Islander |
| <b>Education</b>              |       |         |   |
| <b>College Degree</b>         | 16520 | 100.00% |   |
| <b>Masters Degree</b>         | 4964  | 30.05%  |   |
| <b>Doctorate</b>              | 68    | 0.41%   |   |
| <b>Age at Entry</b>           |       |         |   |
| <b>17</b>                     | 76    | 0.46%   |   |
| <b>18</b>                     | 297   | 1.80%   |   |
| <b>19</b>                     | 304   | 1.84%   |   |
| <b>20</b>                     | 534   | 3.23%   |   |
| <b>21</b>                     | 2605  | 15.77%  |   |
| <b>22</b>                     | 5448  | 32.98%  |   |
| <b>23</b>                     | 2821  | 17.08%  |   |
| <b>24</b>                     | 1474  | 8.92%   |   |
| <b>25</b>                     | 940   | 5.69%   |   |
| <b>26</b>                     | 660   | 4.00%   |   |
| <b>27</b>                     | 378   | 2.29%   |   |

**Table 3. The Sample (16,520 Observations)**

|    |     |       |  |
|----|-----|-------|--|
| 28 | 250 | 1.51% |  |
| 29 | 175 | 1.06% |  |
| 30 | 99  | 0.60% |  |
| 31 | 90  | 0.54% |  |
| 32 | 42  | 0.25% |  |
| 33 | 26  | 0.16% |  |
| 34 | 19  | 0.12% |  |
| 35 | 12  | 0.07% |  |

**Table 3. The Sample (Continued)**

***b. The Male Sample Distribution***

Table 4 indicates how the sample of male officers (14,437 observations) is distributed, by variable. The vast majority of officers commissioned in 1983 are male (87.39%).

Most male officers entering the military are between 21 and 25; 33.44 percent are 22 years of age. This means that a typical officer is a white male in his twenties who received his commission from ROTC or OCS after graduating from college.

|                               |       |        |  |
|-------------------------------|-------|--------|--|
| <b>Sample Size</b>            | 14437 | 100%   |  |
| <b>Variables Total Sample</b> |       |        |  |
| <b>Source of Commission</b>   |       |        |  |
| <b>Military Academies</b>     | 2658  | 18.41% |  |
| <b>ROTC</b>                   | 5656  | 39.18% |  |
| <b>OCS</b>                    | 5169  | 35.80% |  |
| <b>AVTRPRG</b>                | 634   | 4.39%  |  |
| <b>DIRAPPT</b>                | 320   | 2.22%  |  |

**Table 4. The Male Sample (14,437 Observations)**

|                       |       |         |   |
|-----------------------|-------|---------|---|
| <b>Race</b>           |       | 0.00%   |   |
| <b>White</b>          | 13287 | 92.03%  |   |
| <b>Black</b>          | 841   | 5.83%   |   |
| <b>Other Race</b>     | 309   | 2.14%   | Hispanic, American Indian/Alaskan Native,<br>Asian/Pacific Islander |
| <b>Education</b>      |       |         |   |
| <b>College Degree</b> | 14437 | 100.00% |   |
| <b>Masters Degree</b> | 4299  | 29.78%  |   |
| <b>Doctorate</b>      | 64    | 0.44%   |   |
| <b>Age</b>            |       |         |   |
| <b>17</b>             | 72    | 0.50%   |   |
| <b>18</b>             | 277   | 1.92%   |   |
| <b>19</b>             | 294   | 2.04%   |   |
| <b>20</b>             | 494   | 3.42%   |   |
| <b>21</b>             | 2323  | 16.09%  |   |
| <b>22</b>             | 4828  | 33.44%  |   |
| <b>23</b>             | 2460  | 17.04%  |   |
| <b>24</b>             | 1293  | 8.96%   |   |
| <b>25</b>             | 818   | 5.67%   |   |
| <b>26</b>             | 555   | 3.84%   |   |
| <b>27</b>             | 303   | 2.10%   |   |
| <b>28</b>             | 196   | 1.36%   |   |
| <b>29</b>             | 123   | 0.85%   |   |
| <b>30</b>             | 62    | 0.43%   |   |
| <b>31</b>             | 66    | 0.46%   |   |
| <b>32</b>             | 26    | 0.18%   |   |
| <b>33</b>             | 21    | 0.15%   |   |
| <b>34</b>             | 6     | 0.04%   |   |
| <b>35</b>             | 5     | 0.03%   |   |

**Table 4. The Male Sample (Continued)**

**c. The Female Sample Distribution**

Table 5 indicates how the sample of female officers (2,083 observations) is distributed, by variable. Most female

officers entering the military are between 21 and 24; 29.76 percent are 22 years of age.

Female officers make up 12.6 percent of the sample. Of note in Table 5 is that the percentage of Black female officers (13.83%) is more than double the percentage of Black male officers (6.83%).

**d. The Black Sample Distribution**

Table 6 indicates how the sample of Black officers (1,129 observations) is distributed, by variable. Of note in Table 6 is that the percentage of blacks with Masters Degrees is higher than white or male samples. However, shown in Table 5, the female sample is the highest percentage of Masters Degrees.

**e. The White Sample Distribution**

Table 7 indicates how the sample of white officers (15,024 observations) is distributed, by variable. The white sample distribution is the typical commissioned officer.

**f. The Other Race Sample Distribution**

Table 8 indicates how the sample of Other Race officers (368 observations) is distributed, by variable. This sample is the smallest group and has the highest percentage of Doctorates. However, this is based only on two observations.

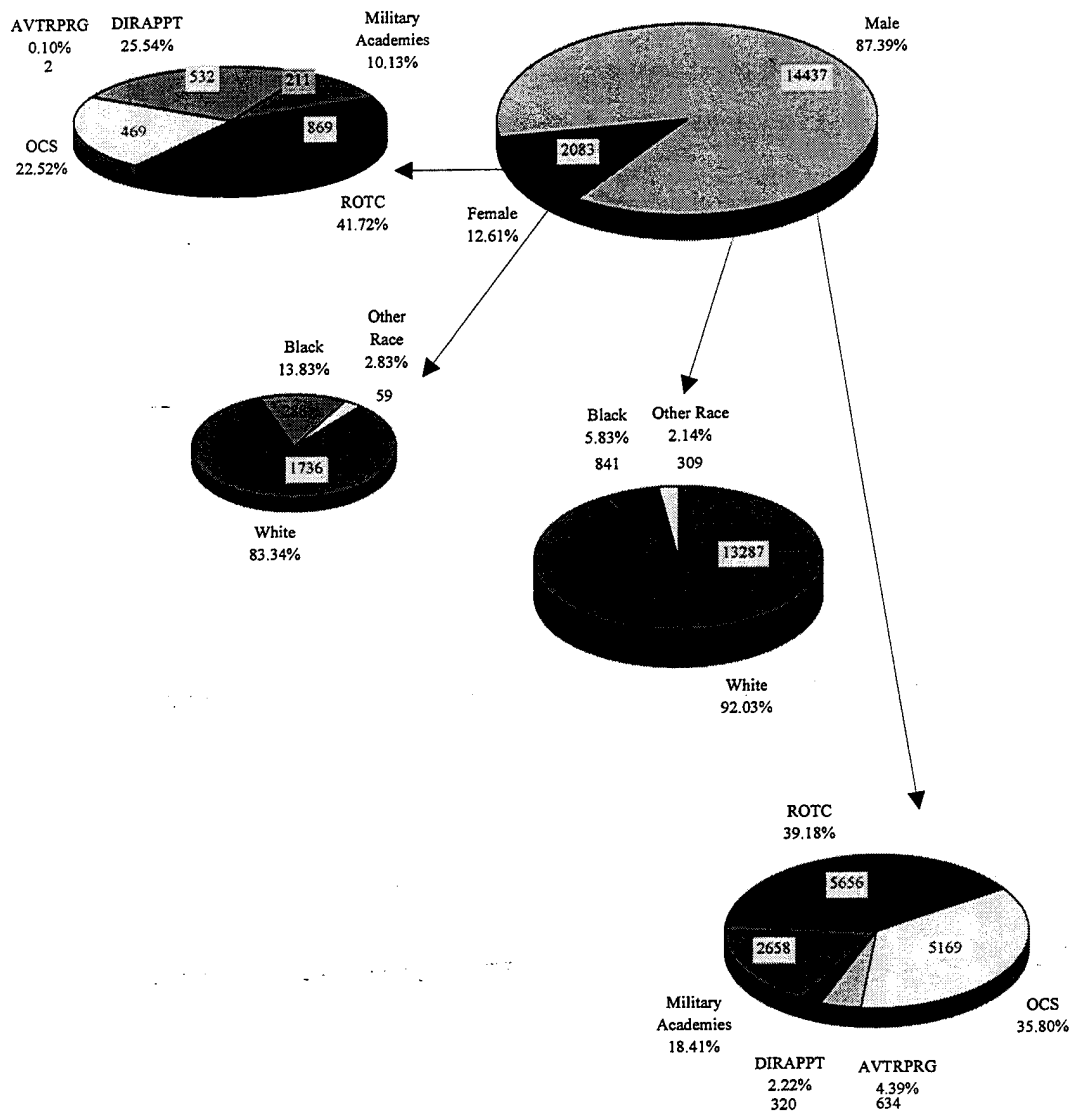
|                        |      |        |  |
|------------------------|------|--------|--|
| Sample Size            | 2083 | 100%   |  |
| Variables Total Sample |      |        |  |
| Source of Commission   |      |        |  |
| Military Academies     | 211  | 10.13% |  |
| ROTC                   | 869  | 41.72% |  |

**Table 5. The Female Sample (2,083 Observations)**



|           |                |      |         |   |
|-----------|----------------|------|---------|---|
|           | OCS            | 469  | 22.52%  |   |
|           | AVTRPRG        | 2    | 0.10%   |   |
|           | DIRAPPT        | 532  | 25.54%  |   |
| Race      |                |      |         |   |
|           | White          | 1736 | 83.34%  |   |
|           | Black          | 288  | 13.83%  |   |
|           | Other Race     | 59   | 2.83%   | Hispanic, American Indian/Alaskan Native,<br>Asian/Pacific Islander |
| Education |                |      |         |   |
|           | College Degree | 2083 | 100.00% |   |
|           | Masters Degree | 665  | 31.93%  |   |
|           | Doctorate      | 4    | 0.19%   |   |
| Age       |                |      |         |   |
|           | 17             | 4    | 0.19%   |   |
|           | 18             | 20   | 0.96%   |   |
|           | 19             | 10   | 0.48%   |   |
|           | 20             | 40   | 1.92%   |   |
|           | 21             | 282  | 13.54%  |   |
|           | 22             | 620  | 29.76%  |   |
|           | 23             | 361  | 17.33%  |   |
|           | 24             | 181  | 8.69%   |   |
|           | 25             | 122  | 5.86%   |   |
|           | 26             | 105  | 5.04%   |   |
|           | 27             | 75   | 3.60%   |   |
|           | 28             | 54   | 2.59%   |   |
|           | 29             | 52   | 2.50%   |   |
|           | 30             | 37   | 1.78%   |   |
|           | 31             | 24   | 1.15%   |   |
|           | 32             | 16   | 0.77%   |   |
|           | 33             | 5    | 0.24%   |   |
|           | 34             | 13   | 0.62%   |   |
|           | 35             | 7    | 0.34%   |   |

Table 5. The Female Sample (Continued)



**Figure 5. The Distribution of Male/Female**

|                        |      |         |  |
|------------------------|------|---------|--|
| Sample Size            | 1129 | 100%    |  |
| Variables Total Sample |      |         |  |
| Source of Commission   |      |         |  |
| Military Academies     | 139  | 12.31%  |  |
| ROTC                   | 642  | 56.86%  |  |
| OCS                    | 240  | 21.26%  |  |
| AVTRPRG                | 15   | 1.33%   |  |
| DIRAPPT                | 93   | 8.24%   |  |
| Education              |      |         |  |
| College Degree         | 1129 | 100.00% |  |
| Masters Degree         | 350  | 31.00%  |  |
| Doctorate              | 1    | 0.09%   |  |
| Age                    |      |         |  |
| 17                     | 4    | 0.35%   |  |
| 18                     | 15   | 1.33%   |  |
| 19                     | 19   | 1.68%   |  |
| 20                     | 34   | 3.01%   |  |
| 21                     | 147  | 13.02%  |  |
| 22                     | 367  | 32.51%  |  |
| 23                     | 214  | 18.95%  |  |
| 24                     | 115  | 10.19%  |  |
| 25                     | 59   | 5.23%   |  |
| 26                     | 44   | 3.90%   |  |
| 27                     | 27   | 2.39%   |  |
| 28                     | 22   | 1.95%   |  |
| 29                     | 23   | 2.04%   |  |
| 30                     | 6    | 0.53%   |  |
| 31                     | 8    | 0.71%   |  |
| 32                     | 9    | 0.80%   |  |
| 33                     | 1    | 0.09%   |  |
| 34                     | 1    | 0.09%   |  |
| 35                     | 4    | 0.35%   |  |

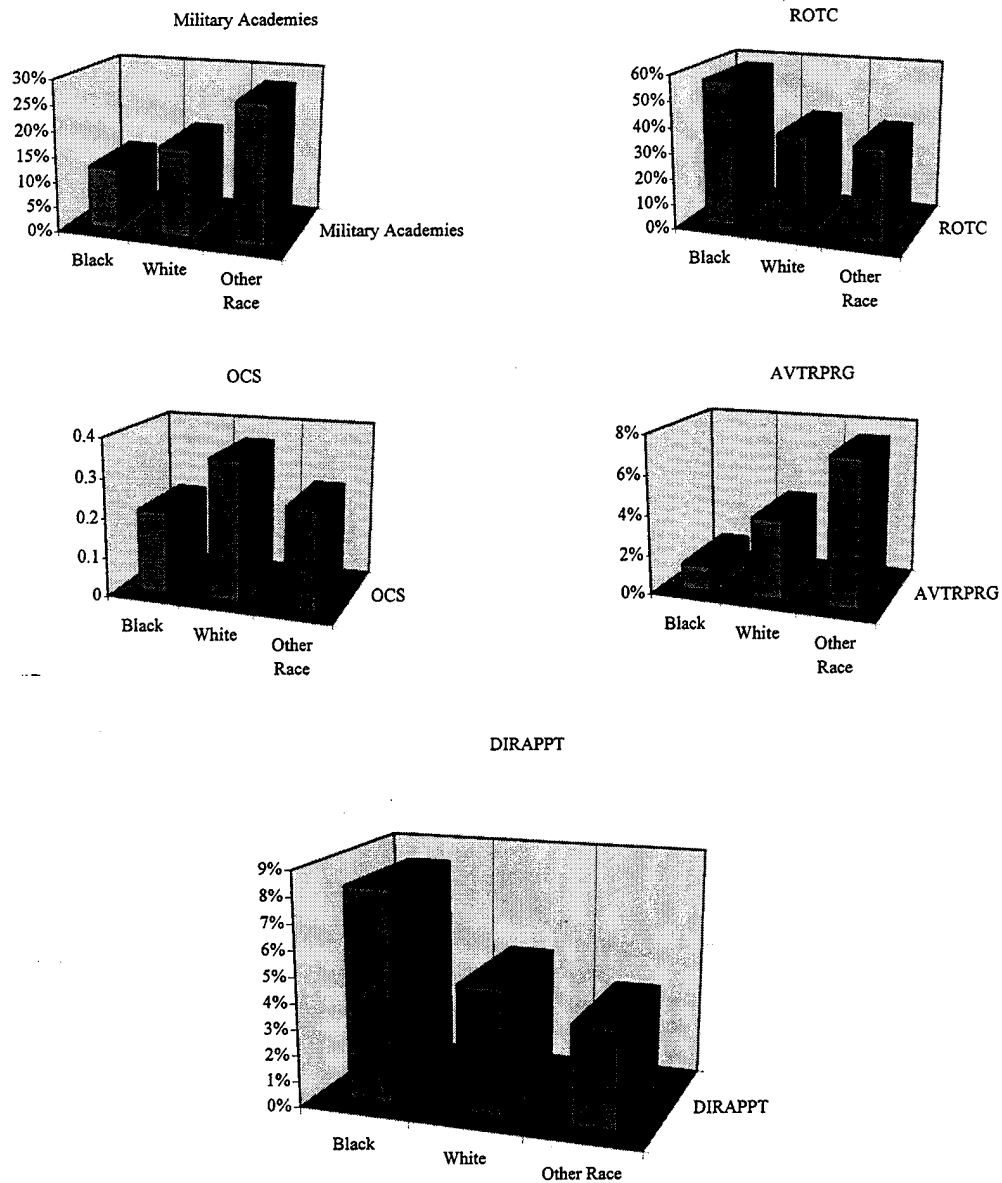
Table 6. The Black Sample (1,129 Observations)

|                        |       |         |  |
|------------------------|-------|---------|--|
| Sample Size            | 15023 | 100%    |  |
| Variables Total Sample |       |         |  |
| Source of Commission   |       |         |  |
| Military Academies     | 2630  | 17.51%  |  |
| ROTC                   | 5749  | 38.27%  |  |
| OCS                    | 5305  | 35.31%  |  |
| AVTRPRG                | 607   | 4.04%   |  |
| DIRAPPT                | 732   | 4.87%   |  |
| Education              |       |         |  |
| College Degree         | 15023 | 100.00% |  |
| Masters Degree         | 4505  | 29.99%  |  |
| Doctorate              | 65    | 0.43%   |  |
| Age                    |       |         |  |
| 17                     | 71    | 0.47%   |  |
| 18                     | 281   | 1.87%   |  |
| 19                     | 277   | 1.84%   |  |
| 20                     | 487   | 3.24%   |  |
| 21                     | 2384  | 15.87%  |  |
| 22                     | 4966  | 33.06%  |  |
| 23                     | 2545  | 16.94%  |  |
| 24                     | 1334  | 8.88%   |  |
| 25                     | 859   | 5.72%   |  |
| 26                     | 599   | 3.99%   |  |
| 27                     | 345   | 2.30%   |  |
| 28                     | 221   | 1.47%   |  |
| 29                     | 148   | 0.99%   |  |
| 30                     | 91    | 0.61%   |  |
| 31                     | 77    | 0.51%   |  |
| 32                     | 31    | 0.21%   |  |
| 33                     | 25    | 0.17%   |  |
| 34                     | 18    | 0.12%   |  |
| 35                     | 8     | 0.05%   |  |

Table 7. The White Sample (15,023 Observations)

|                        |     |         |  |
|------------------------|-----|---------|--|
| Sample Size            | 368 | 100%    |  |
| Variables Total Sample |     |         |  |
| Source of Commission   |     |         |  |
| Military Academies     | 100 | 27.17%  |  |
| ROTC                   | 134 | 36.41%  |  |
| OCS                    | 93  | 25.27%  |  |
| AVTRPRG                | 27  | 7.34%   |  |
| DIRAPPT                | 14  | 3.80%   |  |
| Education              |     | 0.00%   |  |
| College Degree         | 368 | 100.00% |  |
| Masters Degree         | 109 | 29.62%  |  |
| Doctorate              | 2   | 0.54%   |  |
| Age at Entry           |     |         |  |
| 17                     | 1   | 0.27%   |  |
| 18                     | 1   | 0.27%   |  |
| 19                     | 8   | 2.17%   |  |
| 20                     | 13  | 3.53%   |  |
| 21                     | 74  | 20.11%  |  |
| 22                     | 115 | 31.25%  |  |
| 23                     | 62  | 16.85%  |  |
| 24                     | 25  | 6.79%   |  |
| 25                     | 22  | 5.98%   |  |
| 26                     | 17  | 4.62%   |  |
| 27                     | 6   | 1.63%   |  |
| 28                     | 7   | 1.90%   |  |
| 29                     | 4   | 1.09%   |  |
| 30                     | 2   | 0.54%   |  |
| 31                     | 5   | 1.36%   |  |
| 32                     | 2   | 0.54%   |  |
| 33                     |     | 0.00%   |  |
| 34                     |     | 0.00%   |  |
| 35                     |     | 0.00%   |  |

Table 8. The Other Race Sample (368 Observations)



**Figure 6. The Distribution of Race and Source of Commission**

**g. The Promotion from O-1 to O-4 Sample Distribution**

Table 9 and Figure 7 indicate how the sample of officers (16520 observations) is distributed, by variable, for officers promoted to O-4.

**2. 1994 College Data and Merged Data Analysis**

In the college file, two variables are used to merge the file with the 1983 cohort file: Social security number (SSN), and college attended. (coding is shown Appendix C.) DMDC provided the Historically Black College and University coding (coding shown Appendix D).

|                               |       |      |        |  |
|-------------------------------|-------|------|--------|--|
| <b>Sample Size</b>            | 16520 | 2357 | 14.27% | Of the 16,520 officer who were O1 in 1983, 2357 were promoted to O4 in 1994. (Promotion Rate of 14.3%) |
| <b>Variables Total Sample</b> |       |      |        |  |
| <b>Source of Commission</b>   |       |      |        |  |
| <b>Military Academies</b>     | 2869  | 410  | 14.29% |  |
| <b>ROTC</b>                   | 6525  | 917  | 14.05% |  |
| <b>OCS</b>                    | 5638  | 702  | 12.45% |  |
| <b>AVTRPRG</b>                | 636   | 130  | 20.44% |  |
| <b>DIRAPPT</b>                | 852   | 198  | 23.24% |  |
| <b>Sex</b>                    |       |      |        |  |
| <b>Male</b>                   | 14437 | 2018 | 13.98% |  |
| <b>Female</b>                 | 2083  | 339  | 16.27% |  |
| <b>Race</b>                   |       |      |        |  |
| <b>White</b>                  | 15023 | 2158 | 14.36% |  |
| <b>Black</b>                  | 1129  | 155  | 13.73% |  |
| <b>Other Race</b>             | 368   | 44   | 11.96% |  |
| <b>Education</b>              |       |      |        |  |
| <b>College Degree</b>         | 16520 | 2357 | 14.27% |  |
| <b>Masters Degree</b>         | 4964  | 1224 | 24.66% |  |
| <b>Doctorate</b>              | 68    | 22   | 32.35% |  |

**Table 9. The Officer Promotion Rate O-1 to O-4 Sample (16,520 Observations)**

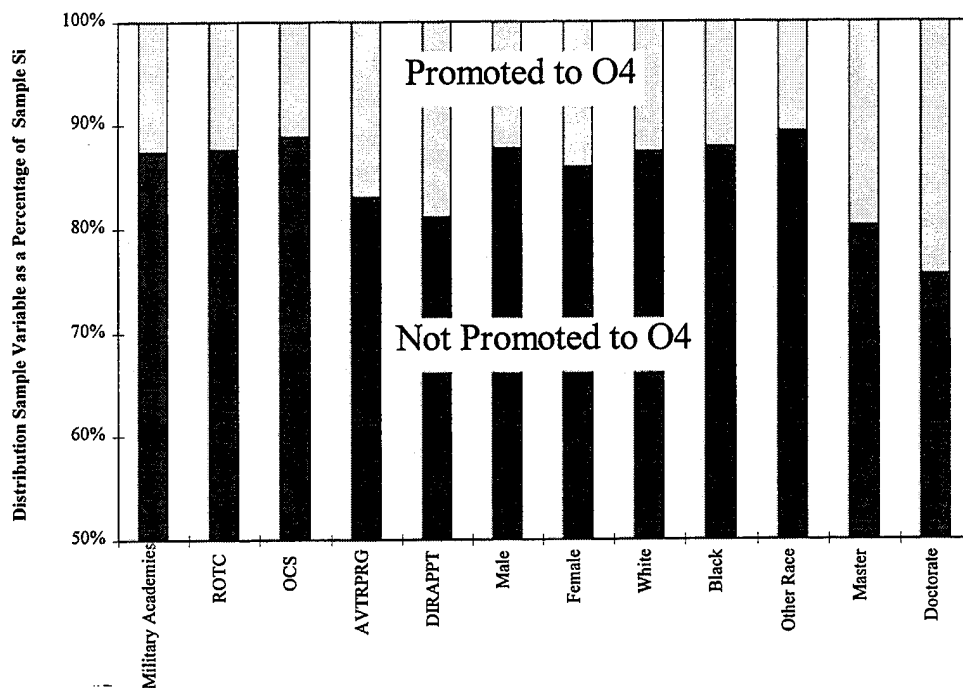
| Age |      |     |        |  |
|-----|------|-----|--------|--|
| 17  | 76   | 14  | 18.42% |  |
| 18  | 297  | 38  | 12.79% |  |
| 19  | 304  | 33  | 10.86% |  |
| 20  | 534  | 70  | 13.11% |  |
| 21  | 2605 | 384 | 14.74% |  |
| 22  | 5448 | 823 | 15.11% |  |
| 23  | 2821 | 357 | 12.66% |  |
| 24  | 1474 | 192 | 13.03% |  |
| 25  | 940  | 133 | 14.15% |  |
| 26  | 660  | 88  | 13.33% |  |
| 27  | 378  | 55  | 14.55% |  |
| 28  | 250  | 50  | 20.00% |  |
| 29  | 175  | 24  | 13.71% |  |
| 30  | 99   | 31  | 31.31% |  |
| 31  | 90   | 21  | 23.33% |  |
| 32  | 42   | 13  | 30.95% |  |
| 33  | 26   | 4   | 15.38% |  |
| 34  | 19   | 7   | 36.84% |  |
| 35  | 12   | 3   | 25.00% |  |

**Table 9. The Officer Promotion Rate O-1 to O-4  
Sample (Continued)**

In the following section, an analysis of the merged data. All records where race was unknown were deleted, along with data where the rank was not O1 in 1983. Finally, officers who separated before 1994 were deleted. This was done in order to successfully merge 1983 cohort and the college files.

These data adjustments were made to analyze the promotion rate of officers (7,718 observations) who were still in the military in 1994.





**Figure 7. The Officer Promotion Rate to O-4**

Three other variables were created as follows:

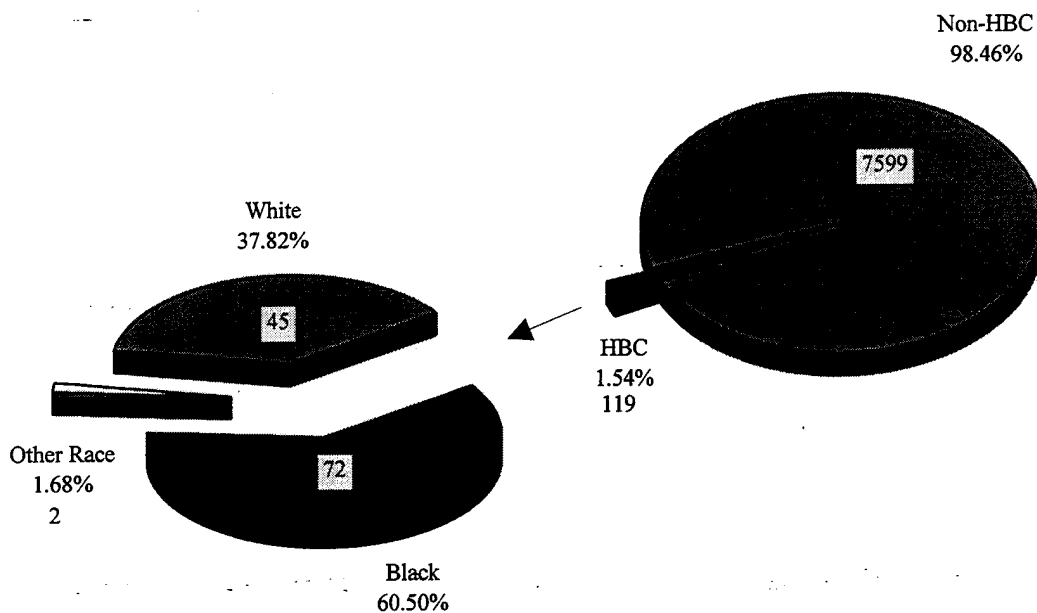
- HBC: officers who graduated from Historically Black Colleges and Universities
- BHBC: black officers who graduated from HBCs
- WHBC: white officers who graduated from HBCs
- OHBC: other race officers who graduated from HBCs

**a. Merged Sample Distribution**

The sample distribution for each of the above variables is shown in Table 10.

|                  |      |         |  |
|------------------|------|---------|--|
| Sample Size      | 7718 | 100.00% |  |
| College Attended |      |         |  |
| HBC              | 119  | 1.54%   |  |
| Non-HBC          | 7599 | 98.46%  |  |
| Race             |      |         |  |
| White            | 6931 | 89.80%  |  |
| HBC              | 45   | 0.58%   |  |
| Black            | 606  | 7.85%   |  |
| HBC              | 72   | 0.93%   |  |
| Other Race       | 181  | 2.35%   |  |
| HBC              | 2    | 0.03%   |  |

**Table 10. The Distribution of Officers in the Merged Data Base (7,718 Observations)**



**Figure 8. The Distribution of Officers in the Merged Data Base (7,718 Observations)**

**b. The Promotion from O-1 to O-4 Merged Sample Distribution**

Table 11 indicates how the sample of officers (7,718 observations) is distributed, by variable for officers promoted to O-4.

|                    |      |      |        |  |
|--------------------|------|------|--------|--|
| <b>Sample Size</b> | 7718 | 3100 | 40.17% | Of the 7718 officer who were O1 in 1983, 3100 were promoted to O4 in 1994. (Promotion Rate of 40.2%) |
| <b>Race</b>        |      |      |        |  |
| <b>White</b>       | 6931 | 2823 | 40.73% |  |
| <b>HBC</b>         | 45   | 27   | 60.00% |  |
| <b>Black</b>       | 606  | 220  | 36.30% |  |
| <b>HBC</b>         | 72   | 24   | 33.33% |  |
| <b>Other Race</b>  | 181  | 57   | 31.49% |  |
| <b>HBC</b>         | 2    | 0    | 0.00%  |  |
| <b>HBC</b>         | 119  | 51   | 42.86% |  |

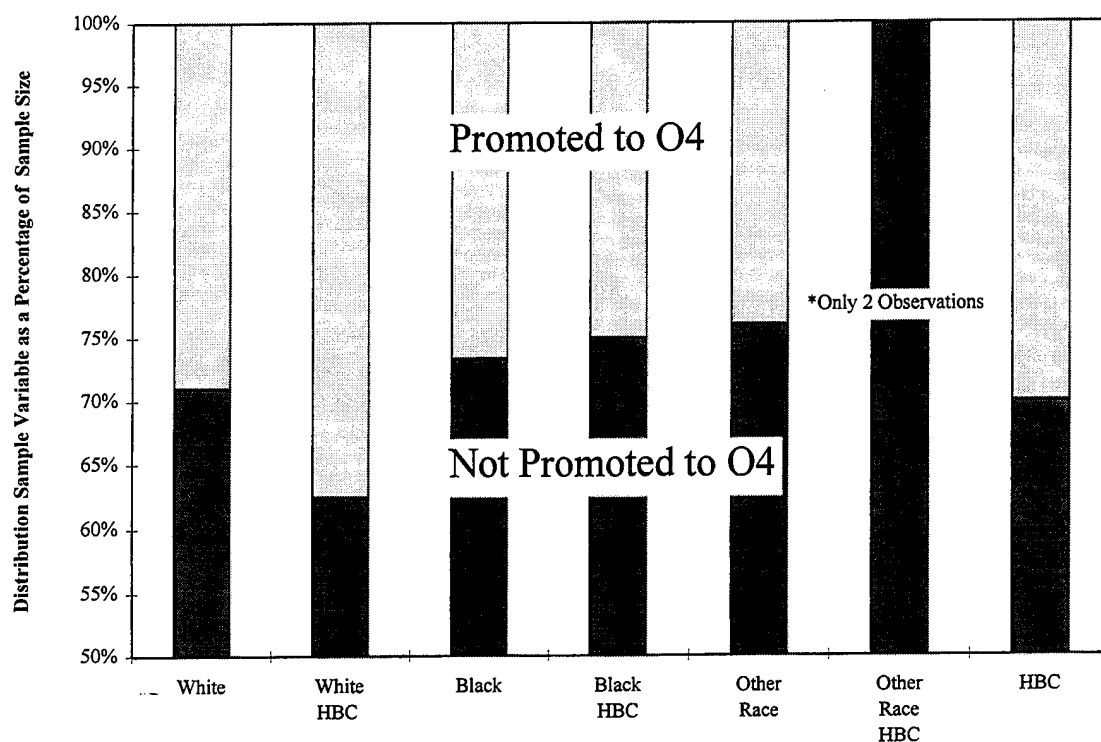
**Table 11. The Officer Promotion Rate to O-4 for Merged Data (7,718 Observations)**

**B. METHODOLOGY**

**1. Choice of Method**

Multiple regression analysis is a valuable statistical technique. It shows the impact of incremental changes in a defined explanatory (independent) variable on a dependent variable, holding all other independent variables constant.

This thesis uses the Logit model and notional person approach analysis. These methods offer calculated changes in the probability of the effect on the dependent variable, and predicted probabilities. Additionally, they minimize the effects of heteroscedasticity.



**Figure 9. The Officer Promotion Rate to O-4**

In the Logit model, the dependent variable is a dichotomous dummy variable, promoted (=0) or fails to be promoted (=1).

The assumed relationship is:

$$P_i = E \left( Y = \frac{1}{X_i} \right) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_i)}} \quad (1)$$

where:

$P_i$  is the probability that an individual is promoted, given the personal attributes  $X_i$ ,

$X_i$  represents data base values for each of the explanatory variables in the model,  
 $e$  is the base of the natural logarithm,  
 $\beta$  represents values of the estimated parameters provided by the Logit Model,  
 $i$  is the number of explanatory variables in the model.

For estimation purposes, the logarithm is written as:

$$L_i = \ln \left( \frac{P_i}{1-P_i} \right) = \beta_1 + \beta_2 X_i \quad (2)$$

where:-

$L_i$  is the log of the odds ratio (Logit),  
 $P_i$  is the probability that an individual is promoted, given the personal attributes  $X_i$ ,  
 $X_i$  is the vector of independent variables for the  $i$ th observation,  
 $\beta_1$  is the intercept,  
 $\beta$  is the coefficient of the regression parameters,  
 $i$  is the number of explanatory variables in the model.

This regression gives the estimated slope ( $\beta$ ), which measures the change in  $L$  for a unit change in  $X$ . It tells how the log-odds in favor of promotion change as  $X$  changes by a unit. The log-of-the-odds ratio is not only linear in  $X$  but also linear in the parameters. [Ref. 13]

The software used was the LOGIT procedure in the Statistical Analysis Software (SAS) package. Logistic regression is widely used to predict probability.

## 2. Multivariate Logistic Regression Model

The empirical model used to find predicted probabilities on officer promotion (using the Logit model and cohort data) is:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(Female) + \beta_2(Academy) + \beta_3(ROTC) \\ + \beta_4(AvTrPrg) + \beta_5(DirAppt) + \beta_6(Black) \\ + \beta_7(OtheRace) + \beta_8(Master) + \beta_9(E\_Age) \quad (3)$$

The maximum-likelihood chi-square statistic measures the confidence of the parameter estimates. The chi-square statistic derived from dividing the parameter estimate by its standard-error and squaring the result. The probability of exceeding that chi-square statistic through random chance indicates whether the variable may be accepted or rejected for a given significance level.

The empirical model examining only graduates of HBCUs is:

$$\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(Female) + \beta_2(Academy) + \beta_3(ROTC) \\ + \beta_4(AvTrPrg) + \beta_5(DirAppt) + \beta_6(Black) + \beta_7(OtheRac) \\ + \beta_8(Master) + \beta_9(E\_Age) + \beta_{10}(HBC) \quad (4)$$

## 3. Notional Person Analysis

The notional person approach defines a "notional" person to determine the overall promotion probability. The change in probability associated with any given independent variable can then be calculated for this "notional" person. The sign on the "YHAT" estimate indicates whether the variable is associated with an increase or decrease in the probability of selection.

$$\begin{aligned}
\hat{Y} = \text{Probability of Promotion} = & \\
\beta_0 + \beta_1(\text{Female}) + \beta_2(\text{Academy}) + \beta_3(\text{ROTC}) & \\
+ \beta_4(\text{AvTrPrg}) + \beta_5(\text{DirAppt}) + \beta_6(\text{Black}) & \quad (5) \\
+ \beta_7(\text{OtherRace}) + \beta_8(\text{Master}) + \beta_9(\text{E\_Age}) & \\
+ \beta_{10}(\text{HBC}) &
\end{aligned}$$

The notional person method is used to evaluate the effect of a single explanatory variable on the probability of promotion. This is done by setting all the explanatory variables to their mean value. In the case of the dummy variables Females through Master, this value is set to zero and for the continuous variable E\_Age this value is set to the mean age of 22.15 years. Each variable is independently tested by increasing it by one and the effect of that variable on the probability of promotion is gauged by subtracting the result of this change from the result with all variables set at the mean.





#### IV. ANALYSIS

##### A. 1983 COHORT DATA

###### 1. Analysis

This Section focuses on 16,520 sample observations. There are 14,437 (87.4%) males and 2,083 (12.6%) females. The most common source of commissioning is the Reserve Officer Training Corps, accounting for 39.5 percent of the sample. Over ninety percent of observations represent white officers; officers of black and other races are 6.8 percent and 2.2 percent of the sample, respectively.

The results of this analysis are:

- The promotion rate to O-4 of possessing master degree is significant.
- The promotion rate to O-4 of males is greater than females'.
- The promotion rate to O-4 of graduates from military academy school is greater than the other source of commission's.
- The promotion rate to O-4 of age of entering military is significant.
- The promotion rate to O-4 of white officers is greater than black officers, and graduating from HBCU is not significant in 1983 cohort.

###### a. *Master and Doctorate Degrees*

Thirty percent of officers received masters degrees before 1994, and 0.4 percent of officers received doctorate degrees. Theoretically, higher education should lead to a higher probability of promotion. The following Logit model confirms this hypothesis.

The percentage of females with masters degree is 31.93 percent, and greater the males' percentage (29.78%); yet there are 0.44 percent males with doctorate degree and only 0.19 percent of females have doctorates.

In the distribution of education there are 31 percent of Blacks with master degrees this is higher than whites (29.99%). Blacks with doctorates is 0.09 percent which is lower than the whites (0.43%).

Of note is that 29.62 percent of other races have master degree and 0.54 percent have doctorate degree which is the highest percentage of the sample.

It can be inferred that the promotion rate of officers having doctorate degrees is greater than for those who have master degrees. However, considering the sample size, 68 doctorates, the perception may be untrue and the doctorate and masters degree group may simply have a higher performance level which leads to a higher promotion rate. The percentage of promotion rate for officers possessing doctorates degrees is 32.35 percent, greater than those who possess only master degrees (24.66%).

**b. Promotion Rate**

From the data we can see that the females' promotion rate (16.27%) is higher than the males' (13.98%).

**c. Military Academy**

The percentage of males from military academies is 18.41 percent while the percentage of females is 10.13 percent. The promotion (to O-4) rate of the sample is 14.3 percent. For Direct Appointment officers it was 23.24 percent (the highest). Aviation Training Program accounted for 20.44 percent. Military academies was 14.29 percent with RTOC was 14.05 percent.

**d. Black and White Promotion**

Generally speaking, the promotion rate of whites was (14.36%) and is greater than Blacks (13.73%) this is only a small difference (0.63%). On the other hand, the rate for other races is the lowest (11.96%).

## 2. Logit Model Result Analysis

In accordance with established procedures for constructing a LOGIT model, a "base case" was chosen to provide a reference point from which to determine probabilities for the remaining variables. The base case variables chosen are "MALE", "OCS", "WHITE," and "COLLEGE." From SAS output (Table 12), an analysis of Maximum Likelihood Estimates indicates that several variables have a positive influence on the probability of promotion.

| Variable  | Parameter Estimate | Standard Error | Wald Chi-Square | Pr > Chi-Square | Standard Estimate | Odds Ratio |
|-----------|--------------------|----------------|-----------------|-----------------|-------------------|------------|
| INTERCEPT | -3.1274            | 0.1690         | 342.6301        | 0.0001          |                   | 0.044      |
| FEMALE    | 0.00615            | 0.0715         | 0.0074          | 0.9315          | 0.001125          | 1.006      |
| ACADEMY   | 0.2398             | 0.0691         | 12.0354         | *0.0005         | 0.050092          | 1.271      |
| ROTC      | 0.2015             | 0.0559         | 12.9765         | *0.0003         | 0.054296          | 1.223      |
| AVTRPRG   | 0.8765             | 0.1095         | 64.0740         | *0.0001         | 0.092976          | 2.402      |
| DIRAPPT   | 0.8441             | 0.1000         | 71.1875         | *0.0001         | 0.102932          | 2.326      |
| BLACK     | -0.1157            | 0.0930         | 1.5481          | 0.2134          | -0.016095         | 0.891      |
| OTHERACE  | -0.2709            | 0.1665         | 2.6476          | 0.1037          | -0.022042         | 0.763      |
| MASTER    | 1.1485             | 0.0462         | 619.0448        | *0.0001         | 0.290304          | 3.153      |
| E AGE     | 0.0305             | 0.00698        | 19.1310         | *0.0001         | 0.061806          | 1.031      |

Chi-Square = 725.029 with 9 degrees of freedom.  
 \*=Significant at a 99 percent confidence level.

**Table 12. Logistic Procedure**

Only three variables (FEMALE , BLACK, OTHERACE) are not significant (at the 0.01 level of significant or better). The variables ACADEMY and ROTC, are positive and significant at the 0.01 level. This indicates that source of commission from Academy and ROTC increases the likelihood of promotion to O-4.

The variables AVTRPRG AND DIRAPPT, are also positive and highly significant. This indicates that the Aviation Training

Program commission and a Direct Appointment commission increase the likelihood of promotion to O-4.

The variable master is significant at the 0.01 level, and positive. This indicates that possession of a master's degree increases the likelihood of promotion.

Finally, age at entry is positive and significant at level 0.01 significant level. This indicates that age at entry to the military increases the probability of promotion.

### **3. Notional Person Result Analysis**

The "notional person" has 7.9 percent likelihood of being promoted to O-4. The promotion rate increases 0.045 percent if one changes the unit of female. Increasing one unit of Academy and ROTC observation increases the promotion rate 1.9 percent and 1.6 percent, respectively. Increasing of Aviation Training Program and Direct Appointment Officer one unit increases the promotion rate to 9.2 percent and 8.7 percent, respectively. On the other hand, if a one unit increase in Blacks and other race, decreases the promotion rate by 0.8 percent and 1.7, percent respectively. The promotion rate increases 13.4 percent for a one unit increase in master's degree observation. If the age of the officer at the time of commission in entry year is older by one, the probability of promotion to O-4 increases 0.2 percent. This means that people with experience and maturity are promoted at a higher rate. Although the military is a fairly youthful organization. Table 13 shows the results of the "notional person approach". The classification table is in Appendix E.

| Variable | Marginal Effect |
|----------|-----------------|
| FEMALE   | +0.718          |
| ACADEMY  | +0.019          |
| ROTC     | +0.016          |
| AVTRPRG  | +0.092          |
| DIRAPPT  | +0.088          |
| BLACK    | -0.008          |
| OTHERACE | -0.018          |
| MASTER   | +0.134          |
| E_AGE    | +0.002          |

**Table 13. Notional Person Analysis**

## **B. MERGED DATA ANALYSIS**

### **1. Frequency Result Analysis**

This section presents an analysis of the merged data. Observations in this dataset represent officers (7,718) who remained in military from 1983 until 1994. The analysis examines frequency and promotion rates of officers who graduated from Historically Black Colleges and Universities in the 1983 cohort.

From the data, 6,931 observations represent whites, 606 represent blacks and 119 observations graduated from a HBCU. 45 white officers (0.65 percent white) graduated from a HBCU, and 72 blacks graduated from a HBCU.

It must be understood that HBCU students are not a large group recruited into the military. Selection bias that results is discussed in the next chapter.

### **2. The Result of Logit Model**

This is the same model as the previous Logit model reported in Table 12 with two changes. First, the model is estimated on the merged data and all observations without a

valid response for college attended was omitted. Second, an indicator variable, HBC is defined where HBC = 1 if the individual graduated from a historically black college or university and equal to zero if the individual graduated from any other college or university. The model estimated is:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(HBC) + \beta_2(Female) + \beta_3(Academy) + \beta_4(ROTC) \\ + \beta_5(AvTrPrg) + \beta_6(DirAppt) + \beta_7(Black) \\ + \beta_8(OtheRace) + \beta_9(Master) + \beta_{10}(E\_Age) \quad (6)$$

The results from this Logit model are reported in Table 14. The main variable of interest is the parameter estimate for HBC. Graduating from a HBC does not have a statistically significant affect on an officer's probability of promotion. The results for all of the other control variables are reported in Table 12 as well.

| Variable  | D<br>F | Parameter<br>Estimate | Standard<br>Error | Wald Chi-<br>Square | Pr > Chi-<br>Square | Standard<br>Estimate | Odds<br>Ratio |
|-----------|--------|-----------------------|-------------------|---------------------|---------------------|----------------------|---------------|
| INTERCEPT | 1      | -1.0078               | 0.1150            | 76.7577             | 0.0001              |                      | 0.365         |
| HBC       | 1      | -0.0567               | 0.1976            | 0.0824              | 0.7741              | -0.003852            | 0.945         |
| FEMALE    | 1      | 0.5463                | 0.0780            | 49.1094             | *0.0001             | 0.093469             | 1.727         |
| ACADEMY   | 1      | -0.4418               | 0.0708            | 38.8905             | *0.0001             | -0.089770            | 0.643         |
| ROTC      | 1      | -0.2793               | 0.0540            | 26.7880             | *0.0001             | -0.073555            | 0.756         |
| AVTRPRG   | 1      | 3.0217                | 0.3668            | 67.8652             | *0.0001             | 0.216015             | 20.527        |
| DIRAPPT   | 1      | 0.9535                | 0.1320            | 52.1436             | *0.0001             | 0.103701             | 2.595         |
| BLACK     | 1      | -0.0002               | 0.1024            | 0.0000              | 0.9984              | -0.000026226         | 1.000         |
| OTHEREACE | 1      | -0.5097               | 0.2143            | 5.6590              | *0.0174             | -0.033756            | 0.601         |
| MASTER    | 1      | -0.1854               | 0.0483            | 14.7300             | *0.0001             | -0.051045            | 0.831         |
| E_AGE     | 1      | 0.0342                | 0.00496           | 47.4766             | *0.0001             | 0.096799             | 1.035         |

Chi-Square = 466.047 with 10 degrees of freedom.  
 \*=Significant at a 99 percent confidence level.

**Table 14. Analysis of Maximum Likelihood Estimates**

While most of the results are consistent with previous results, there are a few results that appear to contradict the results from the previous Logit. Whereas in the previous model both ACADEMY and ROTC had a significant positive effect on promotion, in this model both of these variables have a significant negative effect on promotion. This may suggest that the assumption that promotion behavior in the merged sample is similar to the promotion behavior in the complete sample is mistaken. Future research should focus on improving the data on an officer's college attended.

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

The purpose of the military promotion system is to keep adequate numbers of qualified officers in every pay grade, and available to fill vacancy positions in the military hierarchy. The system should reward high performing officers with promotions to higher positions of authority and increased responsibility. This study investigates the determinants of promotion in the U.S. Military.

Black colleges and universities, despite limited resources, have performed a necessary service to the black communities and to the country. Without them the educational and occupational gaps between blacks and whites in this country would be much greater than they are now.

This thesis investigates the effect of attending a HBCU on promotion to O-4 in the U.S. Military. It also investigates the effect of various other characteristics on promotion. A discussion of the results of the analysis follows:

As expected, this study found that the promotion rate of males (13.98%) is less than that of females' (16.27%).

This study also found that the promotion rate of direct appointment and aviation training program officers is higher than that of officers from the military academies and ROTC. The study shows all of the above sources of commission are significant in the Logit regression model.

Officers who possess master and doctor degrees have higher promotion rates. This means that in the U.S. Military education level is still an important factor influencing O-4 promotion.



Generally speaking, the earlier an officer enters the military, the more military experiences he will have. This experience will help him to be more easily promoted. The results of the study the age of entering military is a significant factor in Logit model on promotion. But from the result of the promotion rate by each age (17 to 35) in Chapter III, Table 9 it can be seen that it is not true that the earlier you enter the military, the greater chance you will be promoted.

The promotion rate of white officers is 14.36 percent, a little greater than the promotion rate for black officers (13.73%). It is consistent with the reference cited in Chapter II in section on outside employment opportunities. The model indicates that minority members will be promoted as quickly as the majority members. From the Logit model, the promotion rate of Black Officers is not statistically different than the promotion rate of whites.

Loren M. Solnick found that graduates of black colleges start with higher salaries, but receive smaller wage increases and fewer promotions. This research finds a positive coefficient for attending a HBCU, though this finding is not significant in the Logit model. However, we noticed that the sample of individuals attending a HBCU is very small. In view of the preceding conclusions the following recommendations are offered.

#### **B. RECOMMENDATIONS**

- This thesis employed the 1983 cohort data. The data period is from 1983 to 1994. Officers who had not been promoted to O-4 in 1994 may still have opportunities for promotion to O-4 and are still in the promotion zone. The dependent variable (PROM) of this regression model is missing from many entries of the cohort. I recommend that future research use

earlier cohort data to do the advanced research of promotion rate.

- DMDC can only provide the college file data after 1991. This has restricted the scope of this thesis. The lack of data from 1983 to 1991 may result in a large bias when the college file is merged with earlier cohort data. (This resulted in the factor of the frequency of missing values because the merged file cannot be merged one by one). For this reason, in the second part of the thesis dealing with HBCU, there are only 7718 observations on the sample. Only 119 observation college attending are HBCU. I recommend using earlier college files from another data center to increase the sample of individuals who attended a HBCU.
- Increasing the number of black officers is a stated policy goal of the U.S. Navy. I recommend further research into the performance of HBCU graduates in the U.S. Navy. If graduates of HBCU's perform as well or better than graduates of other colleges and universities this may imply that the U.S. Navy step up its recruiting efforts at HBCU's.

## **APPENDIX A. HISTORICALLY BLACK COLLEGES**

### **Alabama**

Alabama A&M University  
Alabama State University  
Bishop State Junior College  
Carver State Technical College  
Concordia College  
J.F. Drake State Technical College  
Lawson State Community College  
Miles College  
Oakwood College  
Selma University  
Stillman College  
Talladega Collège  
Trenholm State Technical College  
Tuskegee University

### **Arkansas**

Arkansas Baptist College  
Philander Smith College  
Shorter College  
University of Arkansas at Pine Bluff

### **Delaware**

Delaware State College

### **District of Columbia**

Howard University  
University of the District of Columbia

### **Florida**

Bethune Cookman College  
Edward Waters College  
Florida A&M University  
Florida Memorial College

## **Georgia**

Albany State College  
Clark Atlanta University  
Fort Valley State College  
Morehouse College  
Morris Brown College  
Paine College  
Savannah State College  
Spelman College

## **Kentucky**

Kentucky State University

## **Louisiana**

Dillard University  
Grambling State University  
Southern University A&M College  
Southern University/New Orleans  
Southern University/Shreveport  
Xavier University

## **Maryland**

Bowie State University  
Coppin State College  
Morgan State University  
University of Maryland Eastern Shore

## **Michigan**

Lewis College of Business

## **Mississippi**

Alcorn State University  
Coahoma Community College  
Hinds Community College  
Jackson State University  
Mary Holmes College  
Mississippi Valley State University  
Rust College  
Tougaloo College

## **Missouri**

Harris Stowe State College  
Lincoln University

## **North Carolina**

Barber-Scotia College  
Bennett College  
Elizabeth City State University  
Fayetteville State University  
Johnson C. Smith University  
Livingstone College  
North Carolina Agricultural and Technical State University  
North Carolina Central University  
St. Augustine's College  
Shaw University  
Winston-Salem State University

## **Ohio**

Central State University  
Wilberforce University

## **Oklahoma**

Langston University

## **Pennsylvania**

Cheyney University of Pennsylvania  
Lincoln University

## **South Carolina**

Allen University  
Benedict College  
Claflin College  
Clinton Junior College  
Denmark Technical College  
Morris College  
South Carolina State College  
Voorhees College

## **Tennessee**

Fisk University  
Knoxville College  
Lane College  
Lemoyne-Owen College  
Tennessee State University

## **Texas**

Huston-Tillotston College  
Jarvis Christian College  
Paul Quinn College/Dallas  
Paul Quinn College/Waco  
Prairie View A&M University  
St. Philip's College  
Southwestern Christian College  
Texas College  
Texas Southern University  
Wiley College

## **U.S. Virgin Islands**

University of the Virgin Islands

## **Virginia**

Hampton University  
Norfolk State University  
Virginia State University  
St. Paul's College  
Virginia Union University

## **West Virginia**

West Virginia State College  
Bluefield State College

## APPENDIX B. PROGRAM LISTING-COHORT FILE

```
//FINAL JOB USER=S2571,CLASS=H
// EXEC SASBIG
//COHORT83 DD DISP=SHR,DSN=MSS.F3893.COHOFF83
//SYSIN DD *
OPTIONS LINESIZE=80 PAGESIZE=60 NODATE ;

DATA ONE;
SET COHORT83.COHOFF83(READ=CHRISTIE);

IF PG83 NE 21 THEN DELETE;
IF SEX83=0 THEN DELETE;
IF RACE83=0 THEN DELETE;
IF SOC83=0 THEN DELETE;

IF SEX83=1 THEN MALE=1; ELSE MALE=0;
IF SEX83=2 THEN FEMALE=1; ELSE FEMALE=0;

IF SOC83 IN (1 2 3 4 5 6 7) THEN ACADEMY=1 ; ELSE ACADEMY=0;
IF SOC83 IN ( 8 9 ) THEN ROTC=1; ELSE ROTC=0;
IF SOC83=10 THEN OCS=1; ELSE OCS=0;
IF SOC83 IN (13 14) THEN DIRAPPT=1; ELSE DIRAPPT=0;
IF SOC83=15 THEN AVTRPRG=1; ELSE AVTRPRG=0;

IF RACE83=1 THEN WHITE=1; ELSE WHITE=0;
IF RACE83=2 THEN BLACK=1; ELSE BLACK=0;
IF RACE83=3 THEN OTHERACE=1; ELSE OTHERACE=0;

ARRAY EDUC_LEV{13} EDLEV83 EDLEV84 EDLEV85
                EDLEV86 EDLEV87 EDLEV88 EDLEV89 EDLEV90
EDLEV91
```

EDLEV92 EDLEV93 EDLEV94 EDLEV\_L;

COLLEGE=0;

MASTER=0;

DOCTOR=0;

DO I=1 TO 13;

IF EDUC\_LEV{I} LE 10 THEN COLLEGE=1;

ELSE IF EDUC\_LEV{I}=11 THEN MASTER=1;

ELSE IF EDUC\_LEV{I}=12 THEN DOCTOR=1;

END;

E\_AGE=AAE83;

IF PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR PG94=24 OR  
(PG\_L=24 AND (PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR  
PG94=24 ))

THEN PROM=0; ELSE PROM=1;

LABEL MALE='MALE'

FEMALE='FEMALE'

ACADEMY='SOURCE OF COMMISSION FROM MILITARY SCHOOL'

ROTC='RESERVE OFFICER TRAINING CORPS (SCHOLARSHIP OR  
NON-SCHOLARSHIP'

OCS='OFFICER CANDIDATE SCHOOL'

AVTRPRG='AVIATION TRAINING PROGRAM'

DIRAPPT='DIRECT APPOINTMENT PROF AND NON PROF'

WHITE='RACE: WHITE PEOPLE'

BLACK='RACE:BLACK PEOPLE'

OTHERACE='HISPANIC, AMERICAN INDIAN, ASIAN/PACIFIC  
ISLANDER'

COLLEGE='BACHELORS DEGREE'

MASTER='MASTERS DEGREE'

DOCTOR='DOCTORATE AND FIRST-PROFESSIONAL DEGREE'



E\_\_AGE='AGE AT ENTRY'

PROM='FROM 01 TO 04 OFFICER FROM 1983 THROUGH 1994'

;

PROC MEANS;

VAR MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK  
OTHERACE

COLLEGE MASTER DOCTOR E\_\_AGE PROM

PROC FREQ;

TABLES MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE  
BLACK OTHERACE

MASTER DOCTOR E\_\_AGE PROM

MALE\*(ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK OTHERACE  
MASTER DOCTOR E\_\_AGE PROM)

FEMALE\*(ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK  
OTHERACE  
MASTER DOCTOR E\_\_AGE PROM)

BLACK\*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT OTHERACE  
MASTER DOCTOR E\_\_AGE PROM)

WHITE\*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT OTHERACE  
MASTER DOCTOR E\_\_AGE PROM)

OTHERACE\*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT  
OTHERACE  
MASTER DOCTOR E\_\_AGE PROM)

PROM\*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE  
BLACK OTHERACE

COLLEGE MASTER DOCTOR E AGE );

DATA ELEVEN;

INPUT FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE

MASTER E AGE;

KEEPME=1;

CARDS;

0 0 0 0 0 0 0 0 22.15

1 0 0 0 0 0 0 0 22.15

0 1 0 0 0 0 0 0 22.15

0 0 1 0 0 0 0 0 22.15

0 0 0 1 0 0 0 0 22.15

0 0 0 0 1 0 0 0 22.15

0 0 0 0 0 1 0 0 22.15

0 0 0 0 0 0 1 0 22.15

0 0 0 0 0 0 0 1 22.15

0 0 0 0 0 0 0 0 23.15

;

DATA TWELVE;

SET ELEVEN ONE;

PROC LOGISTIC;

MODEL PROM=FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE

MASTER E AGE /CTABLE;

OUTPUT OUT=MARGPROB P=YHAT;

DATA THIRTEEN;

SET MARGPROB;

IF KEEPME=1;

PROC PRINT;

VAR YHAT FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE

MASTER E AGE ;

TITLE 'PREDICTED PROBABILITIES';

//

/\*



# APPENDIX C. PROGRAM LISTING-COLLEGE MERGE COHORT

```
//MERGE83 JOB USER=S2571,CLASS=H
// EXEC SASBIG
//COLLEGE DD DISP=SHR,DSN=MSS.SIS34.COLLEGE
//COHOFF83 DD DISP=SHR,DSN=MSS.F3893.COHOFF83
//COHORTBR DD DISP=(NEW,CATLG),UNIT=SYSDA,
//          SPACE=(CYL,(30,10),RLSE),
//          DSN=MSS.S2571.HBC83
//SYSIN DD *
OPTIONS LINESIZE=80 PAGESIZE=60 NODATE ;
DATA COLLEGE;
    INFILE COLLEGE;
    INPUT @1 SSNMAST PIB4.
           ARMYCODE $ 6-11
           AFCDCE $ 12-14
           NAVYCODE $ 15-24;
    LABEL ARMYCODE = 'ARMY COLLEGE ATTENDED'
           AFCDCE = 'AIR FORCE COLLEGE ATTENDED'
           NAVYCODE = 'NAVY COLLEGE ATTENDED';
PROC SORT; BY SSNMAST;
PROC SORT DATA=COHOFF83.COHOFF83 (READ=CHRISTIE) OUT=CBR; BY
SSNMAST;
DATA COHORTBR.COHOORTBR;
    MERGE CBR (IN=KEEPME) COLLEGE ; BY SSNMAST;
IF KEEPME;
```



# APPENDIX D. PROGRAM LISTING-MERGED FILES

```
//ARGUE JOB USER=S2571,CLASS=H
// EXEC SASBIG
//TU DD DISP=SHR,DSN=MSS.S2571.HBC83
//SYSIN DD *
OPTIONS LINESIZE=80 PAGESIZE=60 NODATE ;
DATA ONE;
SET TU.COHORTBR;

IF PG83 NE 21 THEN DELETE;
IF PG94=0 THEN DELETE;
IF RACE94=0 THEN DELETE;

IF NAVYCODE IN:('ALABAM A&M' 'ALABAMA SU' 'ALBANY GA'
'ALCORN MS' 'ALLEN U' 'BARBER SCO' 'BENEDICT' 'BENNETT NC'
'BETHUNE CO' 'BLUFLD WVA' 'BOWIE MD' 'CHEYNEY PA'
'CLAFLIN SC' 'CLARK ATL' 'COAHOMA MS' 'COPPIN MD'
'DELAWARE S' 'DILLARD LA' 'ELZ CTY SU' 'FAYETTEVIL'
'FISK TENN' 'FLA A&M' 'FLA MEMORL' 'FORT VALLE'
'GRAMBLING' 'HAMPTON VA' 'HARRIS MO' 'HINDS MS' 'HOWARD
DC'
'JACKSN MIS' 'JARVIS CH' 'KENTUCKY S' 'KNOXVILLE'
'LANE TENN' 'LANGSTON' 'LAWSON CC' 'LEMOYNE-OW'
'LINCOLN MO' 'LINCOLN PA' 'LIVNGST NC' 'MEHARRY'
'MILES ALA' 'NC AG&TECH' 'NC CENT U' 'OAKWOOD'
'PAINE GA' 'PRAIRIE TX' 'RUST MISS' 'S CAROL SC'
'SAVANNAH' 'SHAW NC' 'SHORTER AR' 'SOUTHRN LA'
'SPELMAN' 'ST AUGUSTI' 'ST PAUL V' 'STILLMAN'
'TALLADEGA' 'TENN SU' 'TEXAS C' 'TEXAS SO U'
'TOUGALOO' 'TUSKEGEE' 'U ARKANSAS' 'U MARYLAND'
'VOORHEES' 'W VA STATE' 'WILBERFORC' 'WILEY TEX'
```

'WINSTON SA' 'XAVIER LA') OR  
 AFPCODE IN: ('AGB' 'ALD' 'ALJ' 'ALM' 'ALQ'  
           'ALU' 'ARD' 'AUS' 'BAI' 'BEH' 'BEK'  
           'BEZ' 'BLE' 'CEI' 'CLA' 'CMN' 'CNV'  
           'CPH' 'DEB' 'DIC' 'ECH' 'FIC' 'FLD'  
           'FLE' 'FOE' 'GRC' 'HAE' 'HAK' 'HDL'  
           'HOQ' 'HUF' 'JAB' 'JAF' 'JOG' 'KED'  
           'KNB' 'LAJ' 'LAK' 'LEE' 'LID' 'LIE'  
           'LIH' 'MBP' 'MDA' 'MEF' 'MOI' 'MOJ'  
           'MOL' 'MOM' 'MUL' 'NHF' 'NJC' 'NLL'  
           'NOE' 'NOF' 'OAB' 'PAL' 'PAW' 'PHF'  
           'PRA' 'RUB' 'SAI' 'SFA' 'SGA' 'SHA'  
           'SHG' 'SOA' 'SPA' 'SQD' 'SQP' 'SRY'  
           'STM' 'SXE' 'TAB' 'TED' 'TEI' 'TEL'  
           'TOD' 'TUF' 'VCJ' 'VIF' 'VIH' 'WEM'  
           'WGH' 'WIB' 'WIC' 'YAC' '032' ) OR  
 ARMYCODE IN: ('001005' '001024' '001033' '001037' '001044'  
           '001046' '001050' '001059' '001087' '001103' '001105'  
           '001428'  
           '001448' '001467' '001478' '001480' '001486' '001544'  
           '001566'  
           '001568' '001582' '001583' '001587' '001590' '001591'  
           '001666'  
           '001704' '001968' '002004' '002006' '002026' '002032'  
           '002062'  
           '002068' '002083' '002106' '002139' '002247' '002289'  
           '002396'  
           '002401' '002407' '002412' '002424' '002425' '002433'  
           '002439'  
           '002466' '002479' '002510' '002528' '002709' '002748'  
           '002905'



'002909' '002911' '002926' '002928' '002936' '002942'  
 '002950'  
 '002962' '002968' '002986' '003026' '003141' '003144'  
 '003157'  
 '003196' '003290' '003317' '003417' '003420' '003424'  
 '003439'  
 '003448' '003455' '003490' '003497' '003499' '003501'  
 '003502'  
 '003506' '003522' '003529' '003548' '003575' '003577'  
 '003602'  
 '003608' '003618' '003630' '003637' '003638' '003642'  
 '003669'  
 '003703' '003714' '003739' '003764' '003766' '003809'  
 '003826'  
 '003842' '003968' '004923' '005363' '006787' '006957' )

THEN HBC =1;

ELSE HBC=0;

IF SEX83=1 THEN MALE=1; ELSE MALE=0;

IF SEX83=2 THEN FEMALE=1; ELSE FEMALE=0;

IF SOC83 IN (1 2 3 4 5 6 7) THEN ACADEMY=1 ; ELSE ACADEMY=0;

IF SOC83 IN ( 8 9 ) THEN ROTC=1; ELSE ROTC=0;

IF SOC83=10 THEN OCS=1; ELSE OCS=0;

IF SOC83 IN (13 14) THEN DIRAPPT=1; ELSE DIRAPPT=0;

IF SOC83=15 THEN AVTRPRG=1; ELSE AVTRPRG=0;

IF RACE83=1 THEN WHITE=1; ELSE WHITE=0;

IF RACE83=2 THEN BLACK=1; ELSE BLACK=0;

IF RACE83=3 THEN OTHERACE=1; ELSE OTHERACE=0;

IF RACE94=2 AND HBC=1 THEN BHBC=1; ELSE BHBC=0;

```
IF RACE94=1 AND HBC=1 THEN WHBC=1; ELSE WHBC=0;
IF RACE94=3 AND HBC=1 THEN OHBC=1; ELSE OHBC=0;
```

```
ARRAY EDUC_LEV{13} EDLEV83 EDLEV84 EDLEV85
                        EDLEV86 EDLEV87 EDLEV88 EDLEV89 EDLEV90
EDLEV91
                        EDLEV92 EDLEV93 EDLEV94 EDLEV_L;
```

```
COLLEGE=0;
MASTER=0;
DOCTOR=0;
DO I=1 TO 13;
IF EDUC_LEV{I} LE 10 THEN COLLEGE=1;
ELSE IF EDUC_LEV{I}=11 THEN MASTER=1;
ELSE IF EDUC_LEV{I}=12 THEN DOCTOR=1;
END;
```

```
E_AGE=AAE83;
```

```
IF PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR PG94=24 OR
(PG_L=24 AND (PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR
PG94=24 ))
THEN PROM=0; ELSE PROM=1;
```

```
LABEL MALE='MALE'
      FEMALE='FEMALE'
      ACADEMY='SOURCE OF COMMISSION FROM MILITARY SCHOOL'
      ROTC='RESERVE OFFICER TRAINING CORPS (SCHOLARSHIP OR
NON-SCHOLARSHIP'
      OCS='OFFICER CANDIDATE SCHOOL'
      AVTRPRG='AVIATION TRAINING PROGRAM'
      DIRAPPT='DIRECT APPOINTMENT PROF AND NON PROF'
      WHITE='RACE: WHITE PEOPLE'
```

```

BLACK='RACE:BLACK PEOPLE'
  OTHERACE='HISPANIC, AMERICAN INDIAN, ASIAN/PACIFIC
ISLANDER'
  COLLEGE='BACHELORS DEGREE'
  MASTER='MASTERS DEGREE'
  DOCTOR='DOCTORATE AND FIRST-PROFESSIONAL DEGREE'
  E_AGE='AGE AT ENTRY'
  PROM='FROM O1 TO O4 OFFICER FROM 1983 THROUGH 1994'

```

```

;
PROC MEANS;
VAR  MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK
OTHERACE
  COLLEGE MASTER DOCTOR E_AGE PROM HBC;

```

```

PROC FREQ;
TABLES FROM *(HBC BHBC WHBC OHBC FEMALE ACADEMY ROTC
  AVTRPRG DIRAPPT WHITE BLACK OTHERACE
  MASTER E_AGE);

```

```

DATA ELEVEN;
INPUT  HBC FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE
  MASTER E_AGE;

```

```

KEEPME=1;
CARDS;
0 0 0 0 0 0 0 0 0 21.68
1 0 0 0 0 0 0 0 0 21.68
0 1 0 0 0 0 0 0 0 21.68
0 0 1 0 0 0 0 0 0 21.68
0 0 0 1 0 0 0 0 0 21.68
0 0 0 0 1 0 0 0 0 21.68
0 0 0 0 0 1 0 0 0 21.68
0 0 0 0 0 0 1 0 0 21.68

```

```

0 0 0 0 0 0 0 1 0 21.68
0 0 0 0 0 0 0 0 1 21.68
0 0 0 0 0 0 0 0 0 22.68
;
DATA TWELVE;
    SET ELEVEN ONE;
PROC LOGISTIC;
MODEL PROM=HBC FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK
OTHERACE
    MASTER E AGE ;

OUTPUT OUT=MARGPROB P=YHAT;
DATA THIRTEEN;
    SET MARGPROB;
IF KEEPME=1;
PROC PRINT;
VAR YHAT HBC FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK
OTHERACE
    MASTER E AGE ;
TITLE 'PREDICTED PROBABILITIES';
//
/*

```

# APPENDIX E. THE LOGISTIC PROCEDURE

## CLASSIFICATION TABLE

| Prob<br>Level | Correct |               | Incorrect |               | Percentages |                  |                  |              |              |
|---------------|---------|---------------|-----------|---------------|-------------|------------------|------------------|--------------|--------------|
|               | Event   | Non-<br>Event | Event     | Non-<br>Event | Correct     | Sensi-<br>tivity | Speci-<br>ficity | False<br>POS | False<br>NEG |
| 0.020         | 2357    | 0             | 14163     | 0             | 14.3        | 100.0            | 0.0              | 85.7         | .            |
| 0.040         | 2357    | 1             | 14162     | 0             | 14.3        | 100.0            | 0.0              | 85.7         | 0.0          |
| 0.060         | 2351    | 179           | 13984     | 6             | 15.3        | 99.7             | 1.3              | 85.6         | 3.2          |
| 0.080         | 2159    | 1744          | 12419     | 198           | 23.6        | 91.6             | 12.3             | 85.2         | 10.2         |
| 0.100         | 1465    | 8621          | 5542      | 892           | 61.1        | 62.2             | 60.9             | 79.1         | 9.4          |
| 0.120         | 1389    | 9438          | 4725      | 968           | 65.5        | 58.9             | 66.6             | 77.3         | 9.3          |
| 0.140         | 1386    | 9468          | 4695      | 971           | 65.7        | 58.8             | 66.9             | 77.2         | 9.3          |
| 0.160         | 1371    | 9564          | 4599      | 986           | 66.2        | 58.2             | 67.5             | 77.0         | 9.3          |
| 0.180         | 1267    | 10186         | 3977      | 1090          | 69.3        | 53.8             | 71.9             | 75.8         | 9.7          |
| 0.200         | 1190    | 10725         | 3438      | 1167          | 72.1        | 50.5             | 75.7             | 74.3         | 9.8          |
| 0.220         | 1052    | 11441         | 2722      | 1305          | 75.6        | 44.6             | 80.8             | 72.1         | 10.2         |
| 0.240         | 859     | 12115         | 2048      | 1498          | 78.5        | 36.4             | 85.5             | 70.5         | 11.0         |
| 0.260         | 223     | 13697         | 466       | 2134          | 84.3        | 9.5              | 96.7             | 67.6         | 13.5         |
| 0.280         | 164     | 13974         | 189       | 2193          | 85.6        | 7.0              | 98.7             | 53.5         | 13.6         |
| 0.300         | 154     | 14009         | 154       | 2203          | 85.7        | 6.5              | 98.9             | 50.0         | 13.6         |
| 0.320         | 149     | 14016         | 147       | 2208          | 85.7        | 6.3              | 99.0             | 49.7         | 13.6         |
| 0.340         | 143     | 14016         | 147       | 2214          | 85.7        | 6.1              | 99.0             | 50.7         | 13.6         |
| 0.360         | 141     | 14020         | 143       | 2216          | 85.7        | 6.0              | 99.0             | 50.4         | 13.6         |
| 0.380         | 128     | 14034         | 129       | 2229          | 85.7        | 5.4              | 99.1             | 50.2         | 13.7         |
| 0.400         | 64      | 14077         | 86        | 2293          | 85.6        | 2.7              | 99.4             | 57.3         | 14.0         |
| 0.420         | 32      | 14121         | 42        | 2325          | 85.7        | 1.4              | 99.7             | 56.8         | 14.1         |
| 0.440         | 15      | 14150         | 13        | 2342          | 85.7        | 0.6              | 99.9             | 46.4         | 14.2         |
| 0.460         | 4       | 14158         | 5         | 2353          | 85.7        | 0.2              | 100.0            | 55.6         | 14.3         |
| 0.480         | 0       | 14161         | 2         | 2357          | 85.7        | 0.0              | 100.0            | 100.0        | 14.3         |
| 0.500         | 0       | 14163         | 0         | 2357          | 85.7        | 0.0              | 100.0            | .            | 14.3         |



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